

## “Review pulp and paper industry gasification activities”

### **Del Raymond**

Weyerhaeuser

Del Raymond is currently the Director of Strategic Energy Alternatives for Weyerhaeuser Company.

Dr. Raymond joined Weyerhaeuser Company in 1977 as Manager of the Energy Department where he was instrumental in the initial organization and growth of that department. He was named Director of the new Energy & Environment Division in 1981, Director of Equipment & Process Technology in 1986, and General Manager of the Sensor & Simulation Products Division in 1989. He was named to his present position following the completion of the sale of the Sensor business in 1991.

Prior to joining the company, Dr. Raymond was Director of Chemicals, Energy, and Effluent Technology with St. Regis Paper Company (now Champion International) in West Nyack, New York.

Dr. Raymond earned his B.S., M.S., and Ph.D. in Chemical Engineering at the University of Maine in Orono, Maine. He is a Co-Chairman of the American Forest & Paper Association Steering Committee for Agenda 2020 and the Recovery Boiler Committee, a director of the University of Maine Pulp and Paper Foundation, and Past Division Chairman of the Forest Products Division of the American Institute of Chemical Engineers.

Among his several past awards, Dr. Raymond was named by the University of Maine Pulp and Paper Foundation to receive its 1981 Honor Award in recognition of his work to enhance the reputation of the University for training people to enter technical careers in the paper and related industries. He also received the Distinguished Engineering Award from the University of Maine in 1993. He received the President’s Award from Weyerhaeuser Company in 1987 for his efforts in forming a new division of the company, and again in 1997 for leading the Agenda 2020 industry technology visioning process.

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## **Forest Products Industry Gasification Combined Cycle Initiative**



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## **Why Gasification and Why Now**

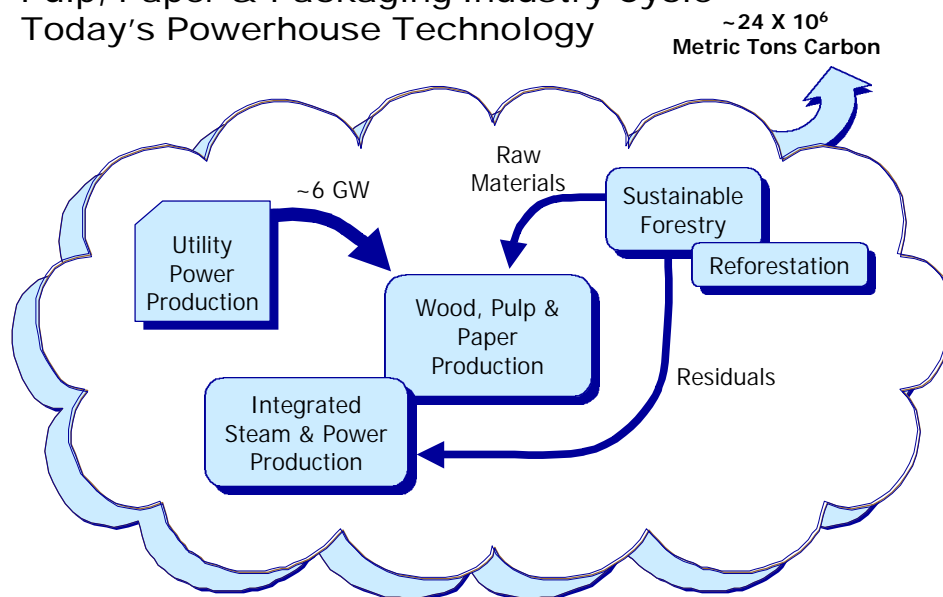
- Economic leverage from the technology is significant
- Technology ready for deployment
- Boiler age distribution and EPA compliance schedule creates window of opportunity
- Potential for serving industry and national needs

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## Shared Industry and National Objectives

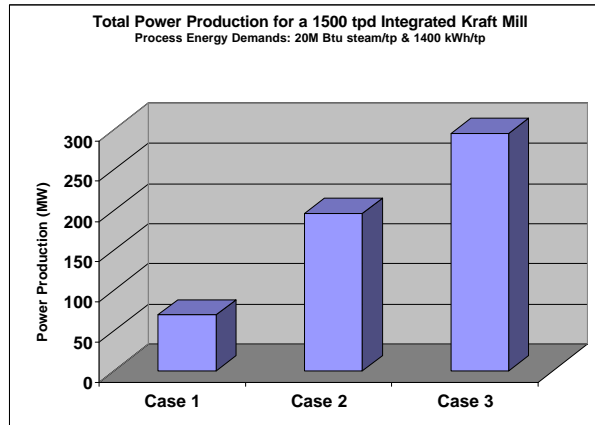
- Improved global competitiveness for U.S. industry
  - Over capital cycle (30+ years), potential for:
    - Reduction of 30+ million metric tons of carbon emissions
    - Renewable energy power opportunity of up to 30 GW
  - 7% industry carbon emission reduction can be achieved with less than 10% conversion
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### Pulp, Paper & Packaging Industry Cycle Today's Powerhouse Technology





## Impact on Power Production



Case 1: Tomlinson boiler + biomass power boiler, back-pressure steam turbine (BPST)

Case 2: Black liquor gasifier + biomass power boiler in combined cycle with BPST

Case 3: Black liquor gasifier + biomass gasifier in combined cycle with BPST

## Recent History

- Commercialization of IGCC technologies – a part of every Energy Performance RFP
- Commercialization of IGCC – a priority of Capital Effectiveness for the last 3 years
- Outreach to suppliers made at Princeton University – January, 1997
- Supplier's message – "User industry must lead"
- Age distribution of facilities and EPA MACT II compliance demand a fast track

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## Recent History

- July 1997 CTOs unanimously agreed that:
- gasification technologies are the first priority for Agenda 2020 demonstration
  - demonstration mill sites from member companies should be sought
- January 1998 Three host mills identified
- March 1998 CTOs approved moving forward with the three projects

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## Recent History

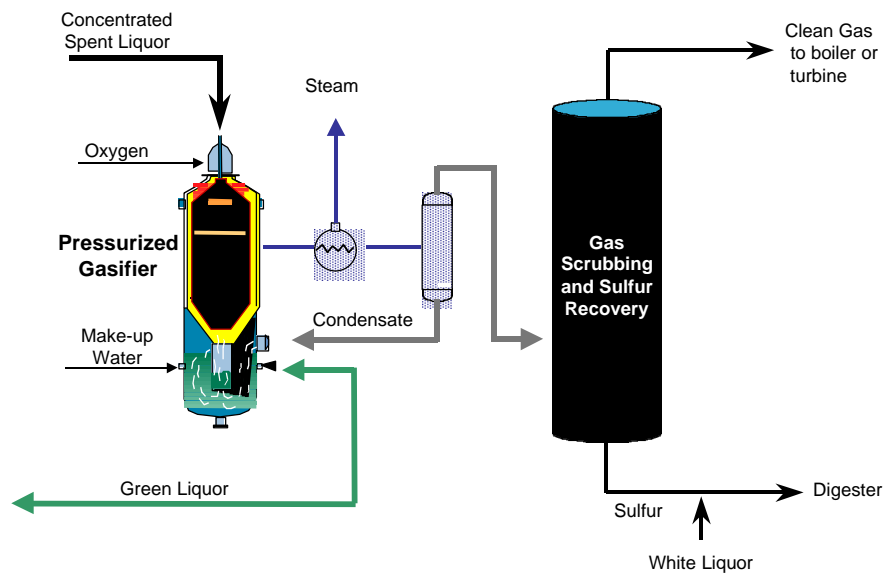
- May 1998 Recommendations made and approved by CEOs
- July 1998 CTOs reconfirmed a 3 project approach
- no other options identified
  - great synergy between the projects
- July 1998 A path forward presented to DOE
- Projects being pursued by:
- Champion
  - Georgia Pacific
  - Weyerhaeuser

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## Air Products/Kværner Chemrec Pressurized Black Liquor Gasifier

- Originated from plasma based technology
  - Lower temperature pilot plant operated in 1987
  - Kværner purchased technology in 1990
  - Operating temperature 1700–1800°F
  - Operating pressure 400 psi
  - Technical principle is entrained droplet
  - Smelt water explosion precluded
  - Can be operated with or without oxygen
  - Champion proposal utilizes oxygen on Kraft black liquor
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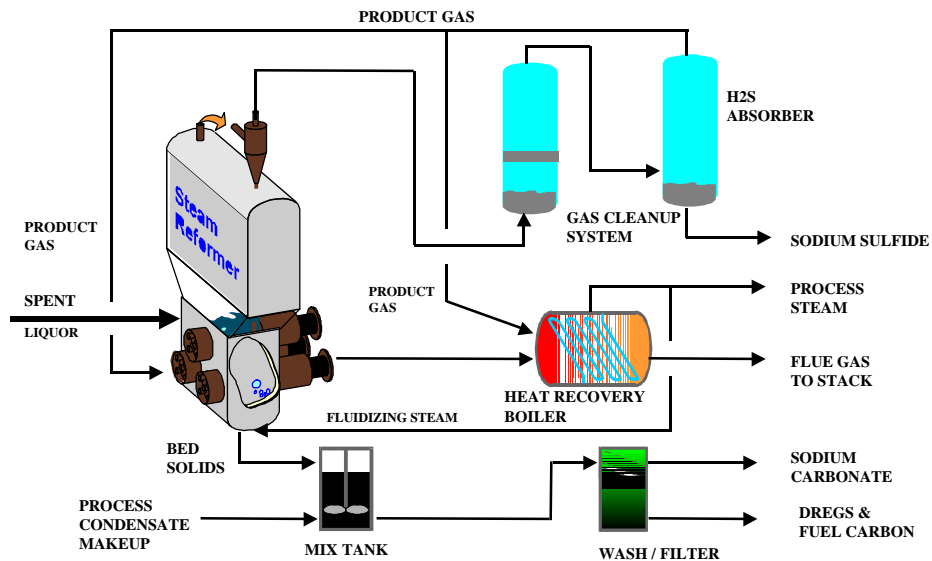
### Kvaerner/Chemrec Pressurized Black Liquor Gasification Champion International – Courtland, Alabama



## MTCI/StoneChem Black Liquor Gasifier

- Originated from pulsed combustion technology
- Small pilot plant operated in 1995
- Technology owned and developed by MTCI/StoneChem
- Operating temperature of 1100°F
- Operating pressure near atmospheric
- Technical principle is pulse-enhanced steam reforming
- Smelt water explosion precluded
- Georgia Pacific project applies technology to caustic carbonate liquor

## MTCI PulseEnhanced™ Steam-Reforming Process Georgia Pacific - Big Island, Virginia





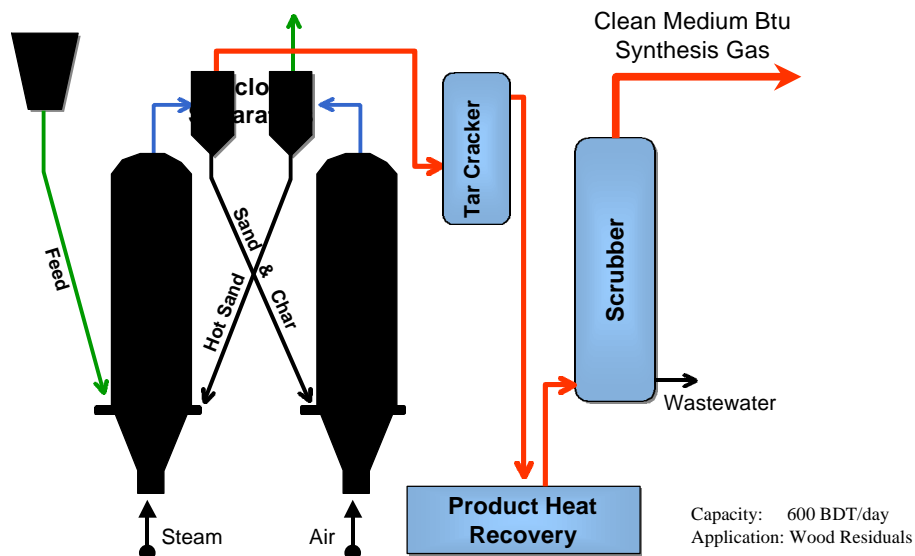
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## Battelle/FERCO Biomass Gasifier

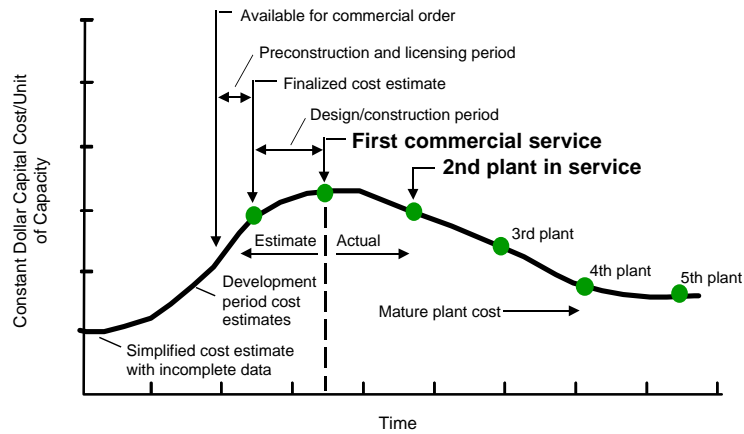
- Originated from entrained reactor and fluid bed technology
- Small pilot plant extensively operated at Battelle Columbus
- Semi-works plant in start-up at Burlington, Vermont
- Technology developed at Battelle; U.S. license owned by FERCO
- Operating temperature – reactor:~1600°F; combustor:~1900°F
- Operating pressure near atmospheric
- Technical principle is low inlet velocity entrained reactor
- Weyerhaeuser project application residual biomass and pulp mill sludges

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## Battelle/FERCO LIVG Gasification System Weyerhaeuser Company – New Bern, North Carolina

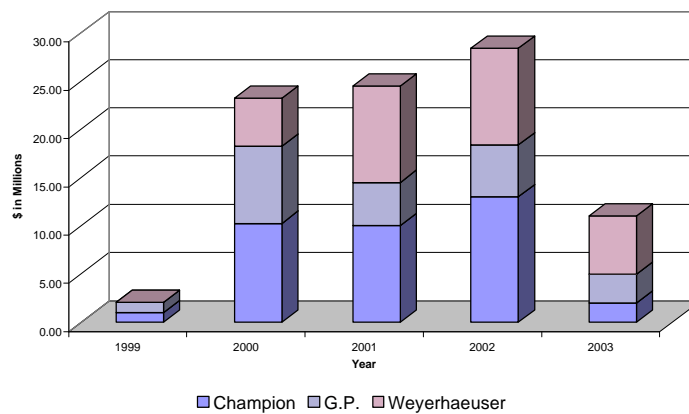


## The “Mountain” of Death



## Project Cash Flow

### Proposed Government Share for the Forest Products Gasification Initiative



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## The Path Forward

- Recommendation to DOE..... July, 1998
- DOE contract negotiations ..... September–October, 1998
- EPA discussions ..... July–October, 1998
- Champion and GP projects  
commence first phase ..... December, 1998
- Weyerhaeuser project commence  
second phase ..... December, 1999

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